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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of	Docket No.: OT-4328
Frank W. Adams, et al.	Date: October 1, 2001
Serial No.: 09/163,259	Group No.: 3652
Filed: September 29, 1998	Examiner: S. McAllister

Title: ELEVATOR SYSTEM HAVING DRIVE MOTOR LOCATED BETWEEN ELEVATOR CAR AND HOISTWAY SIDEWALL

Director of Patents and Trademarks
Washington, D.C. 20231

APPEAL TO THE BOARD OF PATENT APPEALS AND INTERFERENCES PURSUANT TO 37 C.F.R.§1.191

1. REAL PARTY IN INTEREST

The real party in interest is Otis Elevator Company. The assignment of assignor's interest was recorded on January 11, 1999 at reel 9688, frame 0114.

2. RELATED APPEALS AND INTERFERENCES

There are no other appeals or interferences known to appellant, the appellant's legal representative, or assignee which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

3. STATUS OF CLAIMS

Claims 1- 19 are pending in the Application. Of these pending claims, 7 and 9-18 have been withdrawn from consideration based upon an election of species.

Claims 1 and 19 were rejected under 35 U.S.C. 103 (a) as being unpatentable over Aulanko et al. (EP 0710618) in view of Pearson (1035230).

Claims 2-6 and 8 were rejected under 35 U.S.C. 103 (a) as being unpatentable over Aulanko et al. in view of Pearson, and further in view of Olsen.

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Date

4. STATUS OF AMENDMENTS

No amendments were submitted subsequent to the Final Rejection.

5. SUMMARY OF INVENTION

Claims 1 and 19 are directed to an elevator system comprising a hoistway with an elevator car and counterweight located in the hoistway, and a drive motor located between the elevator car and a sidewall of the hoistway. The drive motor is drivingly coupling and suspending the elevator car and counterweight via at least one flat rope.

The primary advantage of the invention of Claim 1 is the elimination of the conventional machineroom located above the hoistway. Further, the combination of the drive motor with flat ropes results in a more compact drive motor that permits the drive motor to be located between the car and a sidewall of the hoistway. Flat ropes reduce the diameter of the drive sheaves and thereby the torque loads on the motor. This effect results in the ability to use a more compact drive motor. The advantage of this combination is that the drive motor does not extend over the top of the car, allowing the car to pass the drive motor and reducing the overhead space requirements for the elevator system.

Claims 2-6 are directed to various advantageous features that may be combined with the invention of Claim 1.

Support for the invention of Claims 1-6, 8 and 19 is found on pages 1, line 23 to page 5, line21, and in figures 1 and 2.

6. ISSUE

(1) Whether the Examiner has met his burden to establish a prima facie case of obviousness under 35 U.S.C. 103 in the rejection of Claims 1 and 19 as unpatentable over Aulanko et al. in view of Pearson?

(2) Whether the Examiner has met his burden to establish a prima facie case of obviousness under 35 U.S.C. 103 in the rejection of Claims 2-6 and 8 as unpatentable over Aulanko et al. in view of Pearson, and further in view of Olsen?

7. GROUPING OF THE CLAIMS

For the purposes of this Appeal, claims 1-6, 8 and 19 stand or fall together

8. ARGUMENT

(1) Whether the Examiner has met his burden to establish a prima facie case of obviousness under 35 U.S.C. 103 in the rejection of Claims 1 and 19 as unpatentable over Aulanko et al. in view of Pearson?

Applicants respectfully submit that the Examiner has not met the burden of proof required to support a rejection under 35 U.S.C. §103. When an application is submitted to the Patent and Trademark Office, case law dictates that 35 U.S.C. §103 places the burden of proof on the PTO to establish a prima facie case of obviousness.[1] Once the prima facie case has been established, then the burden of going forward with the evidence to rebut the prima facie case shifts to the applicant. Only the burden of going forward with evidence to rebut shifts to the applicant, however. The burden of persuasion remains with the PTO.

Further, in order to support a prima facie obviousness type rejection, the Examiner must take into account all the limitations in the rejected claim[2], including any limitations expressed using functional language[3]. Further, the obviousness must be determined based on the claimed subject matter as a whole, including any results and advantages produced by the claimed subject matter[4]. Finally, if the prior art actually teaches away from the claimed invention, this is highly probative, objective criteria fully capable of serving as a foundation for patentability[5] and defeats a rejection's authority as establishing prima facie obviousness[6].

In the application at hand, the Examiner in the Final Rejection states that Aulanko et al. discloses a drive motor between the elevator car and side wall of the hoistway, and that Pearson discloses a flat drive and suspension rope. The Examiner then alleges that it would have been obvious to modify the apparatus of Aulanko et al. by using the flat rope of Pearson in order to produce a large friction surface.

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[1] In re Fritch, 23 U.S.P.Q. 2d. 1780 (Fed. Cir. 1992), In re Piasecki, 745 F.2d. 1468, 1471-1472, 223 U.S.P.Q. 785, 787-788 (Fed. Cir. 1984).
[2] Carl Schenck, A.G. v. Nortron Corp., 713 F.2d 782, 218 U.S.P.Q. 698 (Fed. Cir. 1983); Carman Industries v. Wahl, 724 F.2d 932, 220 U.S.P.Q. 481 (Fed. Cir. 1983).
[3] Lewmar Marine, Inc. v. Barient, Inc., 827 F.2d 744, 3 U.S.P.Q.2d 592 (Fed. Cir. 1983).
[4] Diversitech Corp. v. Century Steps, Inc., 850 F.2d 675, 7 U.S.P.Q.2d 1315 (Fed. Cir. 1988); In re Chupp, 816 F.2d 643, 2 U.S.P.Q.2d 1437 (Fed. Cir. 1987); Fromson v. Advanced Offset Plate, 755 F.2d 1549, 225 U.S.P.Q. 26 (Fed. Cir. 1985).
[5] Raytheon Co. v. Roper Corp., 724 F.2d 951, 220 U.S.P.Q.592 (Fed. Cir. 1983); W.L. Gore & Associates, Inc. v. Garlock, Inc., 721 F.2d 1540, 220 U.S.P.Q. 303 (Fed. Cir. 1983); In re Dow Chemical Co., 837 F.2d 469, 5 U.S.P.Q.2d 1529 (Fed. Cir. 1988).
[6] Graham v. John Deere, 383 U.S. 1, 148 U.S.P.Q. 459 (1966).

Applicants submit, however, that as it regards the subject matter of Claims 1 and 19 this combination of references is improper and fails to take into account all the features and advantages of Applicants' claimed invention.

There is no motivation to combine these two references. The motivation cited in the Final Rejection to justify this combination is to produce a large friction surface. There is no indication within Aulanko et al. that additional friction surface would be desirable and, indeed, in elevator applications, too much friction is a safety hazard. In the event of an overrun of the elevator car, slip between the ropes and the traction sheave is necessary to avoid pulling the car into the roof of the building. This is particularly true for cars that utilize underslung roping as disclosed in Aulanko et al.

Next, and more importantly, the use of flat ropes as disclosed in Pearson with the apparatus of Aulanko et al. would destroy the function and purpose of the invention of Aulanko et al. As stated in the specification (column 1, line 49 to column 2, line 26), the principle objective is a space saving elevator. This is accomplished by using a flat machine unit such that the cross-sectional area of the hoistway is minimized. Using flat ropes, however, requires a traction sheave having an expanded axial dimension to account for the flattening out of the ropes. For the machine of Aulanko et al., this means that the traction sheave (item 7) would need to be extended and therefore the flatness of the machine would be eliminated. As a result, the space required for the machine is expanded and the objective of minimizing cross-sectional hoistway space, i.e., the very heart of the Aulanko et al. reference, is destroyed. In other words, the "flatness" of the Aulanko et al. machine is opposed to the use of flat ropes and Aulanko et al., therefore, teaches away from the present invention as claimed in claims 1 and 19.

Finally, flat, steel straps, such as those suggested in Pearson, are not used in elevator systems for several reasons. First, the straps are cross-sectionally continuous and thus have an effective modulus of elasticity that corresponds to that of steel, i.e., $\sim 30\text{x}10^6$. Materials having this level of flexibility need to be formed very thin in order to be flexible enough to bend around a sheave repeatedly, as is required of elevator ropes. In elevator ropes, this problem is solved by making the rope from a plurality of thin wires. Each wire is very flexible due to its small diameter and as a result the rope is flexible. The strength of the rope, however, is the sum of the load carrying capacity of the individual wires. Therefore, the flexibility of the rope is enhanced by the use of multiple thin wires without a loss of strength.

In effect, the effective modulus of elasticity for a wound wire rope is a fraction of the actual modulus of elasticity of the rope material. This is evidenced in Enclosure #1 and #2, which are representative wire rope properties. Enclosure #1 is taken from a manufacturer's wire rope engineering handbook and indicates that for conventional elevator wound wire ropes (identified by the classification "6x "X" IWRC", where the "X" can vary), the modulus of elasticity is approximately $\sim 12\text{-}13 \times 10^6$. This value is also confirmed in Enclosure #2, which is taken from a rope supplier. This means that the modulus of elasticity for steel straps is on the order of 2-3 times that of wound wire ropes. The result is that for a conventional elevator system to use a steel strap as a lifting rope, assuming the steel strap could be made as thin as the wires of a conventional wound wire rope, the diameter of the sheaves would need to be multiplied by the ratio of modulus of elasticity for steel and the effective modulus of elasticity of a comparable wire rope. Unfortunately, this would result in a very large sheave and very large torque requirements for the drive machine, since the elevator loads and the tension in the ropes is constant. In addition, to support the tensile loads, such a thin strap would need to be inordinately wide. Therefore, one skilled in the art would not consider using flat, steel straps as an elevator rope.

Second, the use of flat straps formed from a continuous material would introduce significant safety issues. Elevator ropes are subject to significant wear and environmental factors. For instance, wear caused by differential motion between the rope and sheave leads to cracks and fractures in the individual wires of the rope. Exposure to moisture leads to rust and pitting of the rope material. In addition, there may be surface imperfections produced during the manufacture of the rope material. Since elevator ropes are under constant tension and repeated flexure, these cracks and fracture propagate through the material. For wound wire ropes, the failure of an individual wire is self-mitigating. Each wire is interwoven with other wires and other strands such that even individual wires with breaks along their length are still useful to carry tension loads (see Enclosure #3 for support for this statement).

For flat straps formed from a continuous material, however, any cracks or fractures would propagate through the strap and result in a catastrophic failure of the rope. This failure mode is unacceptable in elevator ropes. Therefore, one skilled in the art would not consider using flat straps made of steel as an elevator rope.

Third, wound wire ropes take advantage of the additional flexibility provided by the helical wrapping of the strands and cords within the rope. Such helical wrapping permits the wires and strands to move relative to each other to accommodate the differential lengths that the rope is subject to as it travels over a sheave. A steel strap, since it is continuous, cannot accommodate this effect and results in high tensile stress on one side of the strap and high compressive stress on the opposite side of the strap. These repetitive stresses lead to fatigue and cracking of the strap, which, as discussed above, would propagate through the strap and lead to a catastrophic failure. Therefore, one skilled in the art would not consider using flat straps made o steel as an elevator rope.

Fourth, elevator ropes are exposed to and required to operate in a harsh environment. Moisture and other contaminants cause rust and pitting of the rope material. For wound wire ropes, lubrication is used to provide a surface protectant to the wires. For flat straps, however, lubrication would degrade the traction between the strap surface and the sheave. As a result, either the traction between the sheave and strap would be insufficient or, if no lubricant is used, the strap would be subject to significant environmental degradation, which, as discussed above, would result in catastrophic failure of the strap. Therefore, one skilled in the art would not consider using flat straps made of steel as an elevator rope.

Fifth, elevator ropes have a range of traction within which they must operate. If the traction is too low, there is slip during normal operation. For wound wire ropes, environmental contaminants on the rope can be accommodated because of the configuration of the ropes. Traction is produced by the interaction of the crown of the wires and strands with the surface of the sheave, while the spaces between wires and strands can accept the environmental contaminants. For smooth flat straps, however, there are no spaces for the contaminants and this can lead to a dramatic reduction in traction. For instance, moisture on the straps or sheave can result in a film of water that produces a hydrodynamic effect and essentially reduces the traction to zero.

If the traction is too high, there is no slip and there is a risk that the car or counterweight may not break traction when the car or counterweight is at the top of the hoistway. Without slip in this instance, the car or counterweight could be pulled into the overhead of the hoistway. In conventional ropes, an appropriate range of traction is achieved by lubricating the ropes to prevent too much traction, which can occur with dry metal-to-metal contact. For steel straps, however, as discussed above lubrication cannot be used.

Therefore, one skilled in the art would not consider using flat straps made of steel as an elevator rope.

The conclusion then, is that there are significant limitations with using flat straps formed from a cross-sectionally continuous material and those limitations explain why elevator systems do not use such configurations as ropes. This fact is well known to those skilled in the art and such persons, upon receiving a suggestion to use flat steel straps, would immediately disregard the suggestion as **impractical, unsafe and inoperable** in elevator systems. Therefore, one skilled in the art of elevator systems would not consider combining the flat straps suggested in Pearson as elevator ropes with any other elevator system, let alone the combination suggested in this rejection.

Therefore, with respect to Claims 1 and 19, the Final Rejection has failed to establish a prima facie case of obviousness.

(2) Whether the Examiner has met his burden to establish a prima facie case of obviousness under 35 U.S.C. 103 in the rejection of Claims 2-6 and 8 as unpatentable over Aulanko et al. in view of Pearson, and further in view of Olsen?

Applicants respectfully submit that the Examiner has not met the burden of proof required to support this rejection under 35 U.S.C. §103. As stated in the previous discussion, case law dictates that 35 U.S.C. §103 places the burden of proof on the PTO to establish a prima facie case of obviousness.[7] In this instance, a prima facie case would necessarily have to first establish that the present invention would be obvious in view of the cited prior art. As stated previously, the Examiner must take into account all the limitations in the rejected claim[8], including any limitations expressed using functional language[9], and the obviousness must be determined based on the claimed subject matter as a whole, including any results and advantages produced by the claimed subject matter.[10] In order to use a combination of

[7] In re Fritch, 23 U.S.P.Q. 2d. 1780 (Fed. Cir. 1992), In re Piasecki, 745 F.2d. 1468, 1471-1472, 223 U.S.P.Q. 785, 787-788 (Fed. Cir. 1984).
[8] Carl Schenck, A.G. v. Nortron Corp., 713 F.2d 782, 218 U.S.P.Q. 698 (Fed. Cir. 1983); Carman Industries v. Wahl, 724 F.2d 932, 220 U.S.P.Q. 481 (Fed. Cir. 1983).
[9] Lewmar Marine, Inc. v. Barient, Inc., 827 F.2d 744, 3 U.S.P.Q.2d 592 (Fed. Cir. 1983).
[10] Diversitech Corp. v. Century Steps, Inc., 850 F.2d 675, 7 U.S.P.Q.2d 1315 (Fed. Cir. 1988); In re Chupp, 816 F.2d 643, 2 U.S.P.Q.2d 1437 (Fed. Cir. 1987); Fromson v. Advanced Offset Plate, 755 F.2d 1549, 225 U.S.P.Q. 26 (Fed. Cir. 1985).

references to establish a prima facie case of obviousness, there must be some teaching, suggestion or incentive to support the specific combination of references[11].

First, for the same reasons as discussed previously in the traversal of the rejection of Claims 1 and 19, Applicants wish to point out that the combination of Aulanko et al. and Pearson is improper. Therefore, the combination of Aulanko et al., Pearson and Olsen is also improper.

Second, this combination is a clear case of hindsight reconstruction. Aulanko et al. discloses a system having a single set of traction ropes and using separate guide rails for the car and counterweight, with the counterweight rails supporting the machine. Pearson discloses using flat steel. Olsen discloses a system having one set of rails for guiding both the car and counterweight with the machine supported by the hoistway wall. This rejection, however, combines the basic system of Aulanko et al. with the flat ropes of Pearson by assuming that such ropes could be used to suspend the car and counterweight, and then further combines Aulanko et al. with the guide rails of Olsen by assuming that the guide rails of Aulanko et al. could be modified to guide both the car and counterweight and still support the machine. There is no teaching or suggestion that the guide rails of Aulanko et al. could be modified in such a manner and no evidence put forth in the Final Rejection that such a modification is possible.

In effect, this rejection picks and chooses specific features of dramatically different systems, and ignores the differences between the systems, to produce the claimed invention. Therefore, this rejection fails to establish a prima facie case of obviousness.

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[11] In re Geiger, 815 F.2d 686, 2 USPQ2d 1276 (Fed. Cir. 1987); ACS Hospital Systems Inc. v. Montefiore Hospital, 732 Fed.2d 1572, 221 USPQ 929 (Fed. Cir. 1984).

CONCLUSION

As Applicants have traversed each and every rejection raised by the Examiner, it is respectfully requested that the rejections be reversed and the rejected claims be passed to issue. Please charge any additional fees or credit overpayment to Deposit Account No. 15-0750, Order No. OT-4328.

Respectfully submitted,

Adams et al.

Randy G. Henley
Registration No. 35,188

Otis Elevator Company
Ten Farm Springs
Farmington, CT 06032
(860) 676-5742

9. APPENDIX

Claims involved in the Appeal:

1. An elevator system comprising:

a hoistway defined by a surrounding structure;

an elevator car and counterweight located in the hoistway; and

a drive motor located between the elevator car and a sidewall of the hoistway, the drive motor drivingly coupling and suspending the elevator car and counterweight via at least one flat rope.

2. An elevator system as defined in claim 1, further including first and second support columns located on opposite sides of a hoistway relative to each other, each of the support columns extending vertically from a bottom portion to a top portion of the hoistway between the elevator car and said sidewall of the hoistway; and

a support member mounted on and extending generally horizontally between the first and second support columns at a top portion of the hoistway, and wherein the drive motor is supported on the support member.

3. An elevator system as defined in claim 2, wherein the counterweight is located underneath the support member between the elevator car and said sidewall of the hoistway, and the drive motor includes a drive sheave drivingly coupling the elevator car and the counterweight via the flat rope.

4. An elevator system as defined in claim 3, further including a counterweight sheave coupled to a top portion of the counterweight, and at least one elevator sheave coupled to an underside of the elevator car, the flat rope having first and second ends fixedly coupled at a top portion of the hoistway, the flat rope extending downwardly from the first end, looping about the counterweight sheave, extending upwardly and looping about the drive sheave, extending downwardly and underslinging the elevator car via the at least one elevator sheave, and extending upwardly and terminating at the second end.

5. An elevator system as defined in claim 4, wherein the at least one elevator sheave includes first and second elevator sheaves located at an underside of the elevator car and at opposite sides relative to each other.

6. An elevator system as defined in claim 4, wherein the first end of the flat rope is coupled to the support member.

8. An elevator system as defined in claim 2, wherein the first and second support columns respectively include first and second guide members, each of the guide members defining an elevator guide surface extending vertically therealong at least over a length of the support columns corresponding to the path of elevator car travel, and the elevator car defining opposing surfaces shaped to be movably engagable with the elevator guide surfaces as the elevator car moves vertically along the support columns.

19. An elevator system comprising:

a hoistway having a wall;

an elevator car traveling within the hoistway

a counterweight traveling within the hoistway;

one or more flat ropes engaged with the elevator car and counterweight to suspend the car and counterweight; and

a drive machine located between the travel path of the elevator car and the wall of the hoistway, the drive machine engaged with the one or more flat ropes through traction to drive the one or more flat ropes and thereby the car and counterweight.